Claims:

1. A method of x-ray imaging a patient's breast comprising:

immobilizing the breast between a breast platform and a compression paddle, which in turn are between an x-ray source and a digital imaging receptor;

imaging the immobilized breast with x-rays from the source that pass through the breast and impinge on the receptor, from a number of different positions of the source and receptor relative to the breast, to derive image data for the respective positions;

said imaging comprising moving the receptor relative to the immobilized breast while remaining substantially parallel to the same plane and moving the source around the immobilized breast for imaging from each of said different positions; and

using said image data to form images of the breast, wherein each of at least some of said images is formed from image data acquired for two or more of said different positions.

2. The method of claim 1 including maintaining a substantially constant distance from the image receptor to the breast during said imaging.

3. The method as in claim 2 including imaging the immobilized breast at a selected one of said different positions at an x-ray dose comparable to that of a conventional mammogram while the imaging at others of said different positions is at a substantially lower x-ray dose.

4. The method as in claim 3 including positioning the source at a selected one of said different positions with a center ray that is substantially perpendicular to the breast platform.

5. The method of claim 4 including providing an anti-scatter grid between the breast and receptor during said imaging.

6. The method of claim 5 including causing relative motion between the receptor and grid in the course of said imaging.

7. The method of claim 1 including maintaining a substantially constant distance between the grid and the breast during said imaging.

8. The method of claim 1 including carrying said imaging at least at some of said positions without an anti-scatter grid between the breast and the receptor.

9. The method of claim 1 including moving the source through an angle of no more than ±10° relative to the breast during said imaging

10. The method of claim 1 including moving the source through an angle of no more than ±15° relative to the breast during said imaging.

11. The method of claim 1 including moving the source through an angle of no more than ±20° relative to the breast during said imaging.

12. The method of claim 1 including moving the source through an angle of no more than ±25° relative to the breast during said imaging.

13. The method of claim 1 including moving at least the source intermittently between said different positions during said imaging.

14. The method of claim 1 including moving at least the source continuously through said different positions during said imaging.

15. The method of claim 14 including pulsing the x-ray source to emit an imaging x-ray beam intermittently while moving continuously through said different positions.

16. The method of claim 1 including rotating the source about an axis substantially coinciding with the immobilized breast during said imaging.

17. The method of claim 1 including rotating the source about an axis substantially coinciding with the image receptor during said imaging, using fiducial markers during said imaging, and using information from imaging said fiducial markers in forming at least some of said images as tomosynthetic images.

18. The method of claim 1 including restricting the receptor to a motion along a direction generally parallel to the breast platform during said imaging.

19. The method of claim 1 including providing fiducial markers at selected locations relative to the immobilized breast.

20. The method of claim 19 including providing the markers at selected locations relative to the paddle.

21. The method of claim 20 including providing the markers affixed to the paddle.

22. The method of claim 21 including integrating the markers in the paddle.

23. The method of claim 1 including using the image data to form tomosynthetic images of the breast.

24. The method of claim 23 including using fiducial markers during said imaging and using information from imaging said fiducial markers in forming said tomosynthetic images.

25. The method of claim 24 including using said information from imaging the markers for calculating positional relationships between different image data.

26. The method of claim 1 including using said image data to form tomosynthetic images of the breast.

27. The method of claim 26 including forming the images to simulate projection x-ray images of thick slices of the breast.

28. The method of claim 27 in which said images simulate projection images of breast slices that are at least 0.5 cm thick.

29. The method of claim 27 including forming said projection images to simulate images of thick slices that are generally parallel to the breast platform.

30. The method of claim 27 including displaying a number of said images of thick slices for concurrent viewing by a health professional.

31. The method of claim 30 including displaying said images of thick slices and at least one conventional mammogram of the breast for concurrent viewing by a health professional.

32. The method of claim 30 including displaying said images of thick slices and an image of the breast taken at one of said positions at x-ray dosage of a conventional mammogram during said imaging, for concurrent viewing by a health professional.

33. The method of claim 1 including using said image data to form tomosynthetic images of the breast, and displaying the tomosynthetic images for scrolling through different planes of the breast.

34. The method of claim 1 including using a Tungsten source of x-rays as said x-ray source.

35. The method of claim 1 including immobilizing the breast at pressure no more than two thirds that for a conventional mammogram.

36. The method of claim 1 including immobilizing the breast at pressure no more than half that for a conventional mammogram.

37. The method of claim 1 including applying filtered back projection to said image data to form images of selected slices of the immobilized breast, using a filter that in the frequency domain rises significantly more steeply

at lower and intermediate frequencies that filters used in reconstruction of computerized tomography images.

38. The method of claim 37 including carrying said back projection in the frequency domain.

39. The method of claim 37 including carrying out said back projection in the spatial domain.

40. The method of claim 37 including using a filter that is curved at low frequencies when represented in the frequency domain.

41. The method of claim 37 using a filter that rises progressively less steeply with increase in frequency when represented in the frequency domain.

42. The method of claim 40 in which the filter is generally a high pass filter at intermediate frequencies.

43. The method of claim 37 including selectively adjusting a DC point value of the filter to differentiate between regions of said images.

44. A method of x-ray imaging a patient's breast comprising:

immobilizing the breast between a breast platform and a compression paddle, first at a first breast angle of the platform and paddle and then at a second angle of the platform and paddle;

imaging the immobilized breast with x-rays from an x-ray source that pass through the breast at each of said angles of the platform and paddle and impinge on the receptor, from a number of successive different positions of the source and receptor relative to the breast at each of said angles of the platform and paddle, to derive image data for the respective positions;

said imaging comprising rotating the source and receptor around the immobilized breast at each of said angles of the platform and paddle; and

using said image data to form images of the breast, wherein each of at least

some of said images is formed from image data acquired for two or more of said different positions.

45. A breast-imaging x-ray system comprising:

a breast platform and a compression paddle for immobilizing a patient's breast therebetween;

an x-ray source mounted for rotation about the platform and paddle, and selectively emitting a collimated x-ray beam having a center ray that is transverse to the platform;

a digital x-ray receptor mounted for selective translation relative to the breast platform, in a direction that is transverse to a length of a breast immobilized between the platform and paddle and is generally parallel to the breast platform;

said rotation of the source and selective emission of x-rays and said translation of the receptor being synchronized to image a breast immobilized between the platform and paddle at a number of different positions of the source and receptor relative to the platform and produce image data for said positions; and

a processor receiving said image data and using at least some of the data to form tomosynthetic images of a breast immobilized between the platform and paddle.

46. The system of claim 41 including a C-arm supporting the source at one end for said rotation about the platform and paddle, and the receptor at another end for said translation relative to the platform during which the receptor remains substantially parallel to the platform.

47. A method of x-ray imaging a patient's breast comprising:

immobilizing the breast between a breast platform and a compression paddle, which in turn are between an x-ray source and a digital imaging receptor;

imaging the immobilized breast with x-rays from the source that pass through the breast and impinge on the receptor, from a number of different positions of the source relative to the breast, to derive image data for the respective positions;

said source moving in a continuous motion from one to another of at least three of said different positions; and

using said image data to form images of the breast, wherein each of at least some of said images is formed from image data acquired for two or more of said different positions.

48. The method of claim 47 in which the source is pulsed to emit imaging x-ray beams at said imaging positions.

49. The method of claim 47 including moving the receptor to different positions for said imaging positions of the source.

50. The method of claim 49 in which the receptor moves through said different positions while remaining at a substantially constant distance from the breast platform.

51. A method of x-ray imaging a patient's breast comprising:

immobilizing the breast between an x-ray source and a digital imaging receptor;

imaging the immobilized breast with x-rays from the source that pass through the breast and impinge on the receptor, from a number of different relative positions of the source, immobilized breast, and receptor, to derive image data for respective imaging positions;

said source moving through an angle of no more than ±30° relative to the breast through said imaging positions;

using said image data to form images of the breast, wherein each of at least some of said images is formed from image data acquired for two or more of said

imaging positions; and

further processing said image data to selectively form and display further information related to one or more areas of interest in said images.

52. The method of claim 51 in which at least some of the images are thick slice tomosynthetic images.

53. The method of claim 52 in which said further information comprises images of slices that are thinner than said thick slices and relate to at least one region of interest in at least one of the thick slices.

54. The method of claim 52 in which said further information comprises positional data identifying in three dimensions a position of a suspected lesion in the immobilized breast for additional procedures involving the breast.

55. The method of claim 52 in which the further information comprises identifying and displaying a position at one or more of said slices that corresponds to a position at a selected slice of a manually controlled cursor.

56. A method of x-ray imaging a patient's breast comprising:

immobilizing the breast between an x-ray source and a digital imaging receptor;

imaging the immobilized breast with x-rays from the source that pass through the breast and impinge on the receptor, from a number of different relative positions of the source, immobilized breast, and receptor, to derive image data for respective imaging positions;

said source moving through an angle of no more than ±30° relative to the breast through said imaging positions;

using said image data to form images of the breast, wherein each of at least

some of said images is formed from image data acquired for two or more of said imaging positions; and

displaying at least some of said images concurrently at a display manually controlled to display images representing slices of the breast that have selected thicknesses.